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Interactions of Dividend and Investment Decisions
Under Different Growth Opportunities: A Signalling-
Theory Approach

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Decisions Under Different Growth Opportunities:
A Signalling-Theory Approach

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INTERACTIONS OF DIVIDEND AND INVESTMENT
DECISIONS UNDER DIFFERENT GROWTH OPPORTUNITIES:
A SIGNALLING-THEORY APPROACH

Abstract

Based upon the signalling theory, the interactions of dividend and investment decisions are investigated. A new model is developed by integrating and generalizing the models used in previous studies. Effects of growth opportunities are explicitly introduced in this new model. The error component model is used to improve the efficiency of estimators. The results suggest that for high-growth firms the desire to pay reasonable dividends is not adversely affected by investment decisions, while for low growth firms investment decisions do affect dividend decisions.

INTERACTIONS OF DIVIDEND AND INVESTMENT DECISIONS
UNDER DIFFERENT GROWTH OPPORTUNITIES: A
SIGNALLING-THEORY APPROACH

Introduction

The interactions of investment policy and dividend policy have been concerned by Spies [23], Fama [9], Dhrymes and Kurz [8], Miller and Modigliani [19] and others. Two theories exist in the literature regarding the relationships between investment and dividend decisions. The first, based on the perfect capital market theorem, suggests that investment decisions and dividend decisions of firms are not related since, in a perfect capital market, optimal investment decisions by a firm are independent of how such decisions are financed. The second, based on the assumption of imperfect capital markets, proposes that they are negatively related since dividends and investment are competing uses of limited internal funds. Dhrymes and Kurz [8] and Fama [9] have developed simultaneous equation models to test these two extreme hypotheses and obtain entirely different empirical results.

A serious problem which exists in previous studies is the implicit assumption that the firms behave homogeneously regarding dividend and investment decisions; every study tries to prove the validity of one or the other theory for all of the firms concerned. With the heterogeneity of firms, it is doubtful that firms will behave in the same way with regard to investment and dividend decisions. One important factor which might affect firms' behavior is growth orientation of firms. In investigating the relationship between stock price and the changes of dividends, Shiller [22] argues that the growth factor is an important factor

to be concerned. Two opposing arguments can be found which relate growth orientations of firms to their dividend-investment decisions. The first suggests that dividend and investment decisions might not be related for high growth firms, while they are negatively related for low growth firms. According to this theory, if a firm commits itself to rapid growth, a great amount of investment will be needed and internal funds alone are usually insufficient. In order to develop and maintain a good capital market relationship and signal future earnings potential so that external funds are more obtainable, the firm is likely to pay higher dividends than otherwise although the investment demand for the same source of funds is great (see Ross, [21]). There is an interesting argument by Miller and Modigliani [19] that dividend disbursements convey information to the market on the future potential profitability of a firm. Bhattacharya [4, 5] uses a signalling-theory approach to explain firms' dividend-payment decisions. For high-growth firms, therefore, investment and dividends are less likely to be negatively related. On the other hand, for firms with relatively little growth potential which need less outside funds, dividend and investment are likely to be negatively related since they are competing uses of internal funds.

The second theory suggests, however, that dividend and investment decisions are also negatively related for high-growth firms. Since high growth adversely impacts the liquidity position of firms, low dividend payouts shall be associated with those firms (see, for example, Weston and Brigham [25]). In addition, high growth rates imply high profit potentiality, which in turn inspires that earnings be retained rather than distributed to stockholders, whose investment alternatives might

not offer higher returns. High-growth firms can also attract capital-gains oriented investors who are in high income brackets and are more interested in taking their income in the form of capital gain rather than as dividends, which are subjected to higher income tax rates. For high-growth firms, therefore, dividend and investment decisions should also be negatively related.

Such competing theories regarding the effect of growth orientations on dividend-investment decisions have never been tested empirically in financial studies. The purpose of this study is to investigate empirically the difference in behaviors between high-growth and low-growth firms with regard to dividend and investment decisions. The high-growth and low-growth firms will be formed into two separate groups with separate regression equations estimated. It is recognized in this paper that, in addition to growth orientation, many other factors may also affect decisions of a specific firm. It is thus impractical to try to develop a model capable of explaining different situations which lead to decisions of specific firms regarding dividend and investment. In this study, the effect of growth and dividend signalling on the average behavior of firms will be analyzed from results obtained from pooled cross-sectional and time-series data. In the next section, a theoretical model for the study of the relationship between dividend and investment decisions of firms will be developed. In the third section, methods for estimating pooled cross-sectional and time-series data will be introduced. Empirical results will be given and analyzed in the fourth section. In the final section, a brief summary and conclusion will be given.

I. The Model

In this section, a model used in previous studies will first be introduced and commented upon briefly. An alternative model for the study of relationships between dividend and investment decisions of firms will then be derived.

Among studies on dividend behaviors of firms, the partial adjustment model suggested by Lintner [16] has most often been used.¹ Suppose there are observations on N firms over T periods of time. The Lintner model can be written in terms of the following two equations:

$$D_{it}^* = \alpha_1 P_{it} + \eta_{it} \quad (1A)$$

$$\Delta D_{it} = \gamma(D_{it}^* - D_{i, t-1}) \quad 0 < \gamma \leq 1 \quad (1B)$$

$$i = 1, 2, \dots, N$$

$$t = 1, 2, \dots, T$$

where D_{it} is the dividend of firm i in period t , P_{it} is the profit of the same firm in the same period, η is a disturbance term, D^* is the equilibrium (or desired) value of D .² α_1 and γ are parameters to be estimated. The coefficient of adjustment γ should be greater than zero and less than or equal to one and α_1 is a positive fraction.

Combining equations (1A) and (1B), the following estimable equation can be obtained:

$$\Delta D_{it} = \gamma\alpha_1 P_{it} - \gamma D_{i, t-1} + \epsilon_{it} \quad (2)$$

where $\epsilon_{it} = \gamma\eta_{it}$. To study possible effect of investment on dividend, changes in capital stock, ΔK_{it} , can be added to equation (1A) with a coefficient α_2 as

$$D_{it}^* = \alpha_1 P_{it} + \alpha_2 \Delta K_{it} + \eta_{it} \quad (1A')$$

Equation (1A) defines the optimal dividends as the function of the current earnings and equation (1A') defines the optimal dividend as the function of both earnings and investment opportunity. Hence equation (1A') is a generalized specification for equation (1A). Substituting equation (1A') into (2) we obtain

$$\Delta D_{it} = \gamma \alpha_1 P_{it} + \gamma \alpha_2 \Delta K_{it} - \gamma D_{i, t-1} + \varepsilon_{it} \quad (3)$$

in which $\gamma \alpha_2$ indicates the short-run effect of ΔK on ΔD and α_2 is the long-run effect. Due to contradictory theories regarding the relationship between investment and dividend decisions of firms as discussed in the preceding section, the sign of α_2 cannot be resolved a priori and can only be determined empirically. If α_2 is estimated to be negative and statistically significant, dividend and investment of firms are proved to be negatively related and hence the assumption of imperfect capital markets is supported. Otherwise, they are unrelated and hence the implication of the perfect capital market theorem cannot be rejected. Equation (3) is identical to one of the basic equations used by Fama [8] for the study of dividend and investment decisions. However, the basic assumptions used to derive the model are different. Fama [8] bases on the assumption of interdependency between D_{it} and ΔK_{it} to derive equation (3). However, we use an identity similar to that used by Miller and Modigliani [19] and indicated in equation (4) below to derive equation (3):

$$D_{it} = P_{it} - \Delta K_{it} + F_{it} \quad (4)$$

where F_{it} is the amount of external financing; P_{it} and ΔK_{it} are the same as defined in the previous equations. This equation implies that the dividends payments can be affected by earnings, net investments and amount of external financing.

The relationship between ΔK_{it} and F_{it} is generally used to determine whether internal financing or external financing is the major source of new investment. If F_{it} is equal to ΔK_{it} , then the investment decision will not affect the dividend decision. If F_{it} is smaller than ΔK_{it} , then the investment decision will have negative impact to the dividend payment. These arguments do not explicitly take into account the potential "information content" dividend-decision behavior as suggested by Miller and Modigliani [19]. If the managers use dividend changes to signal the potential future earnings of their firms, then the increase of new investments might also increase a firm's dividend payment. To accomplish this strategy, a manager can use more external sources of funds to finance their new investments. Hence the estimated α_2 can be used as an indicator of examining the trade off between the relative importance of dividend signalling and flotation cost. For high growth firms, the dividends signalling is generally more important than the consideration of flotation cost and the estimated α_2 will generally be positive. For low growth firms, the dividend signalling is generally not as important as the consideration of flotation cost. The estimated α_2 will generally be negative as predicted by imperfect market theorists.

The specification of equation (3), however, is biased against possible negative relationship between dividend and investment of a firm. If a firm enjoys greater profits in a year, it is likely that

both dividends paid out and investment of the firm will be increased, and vice versa. Especially due to inflation, ΔD , P and ΔK are even more likely to move in the same direction if undeflated data are used. Due to multicollinearity between P and ΔK , the estimated parameters might also be subject to large sampling errors.

To avoid such specification problems, equation (1A) and (1B) can be rewritten in terms of dividend payout ratio (D_{it}/P_{it}) and the ratio of investment to earnings ($\Delta K_{it}/P_{it}$):

$$\left(\frac{D_{it}}{P_{it}} \right)^* = \beta_0 + \beta_1 \frac{\Delta K_{it}}{P_{it}} + \eta_{it} \quad (5)$$

$$\Delta \left(\frac{D_{it}}{P_{it}} \right) = \gamma \left[\left(\frac{D_{it}}{P_{it}} \right)^* - \frac{D_{i, t-1}}{P_{i, t-1}} \right] \quad (6)$$

where β_0 and β_1 are identical to α_1 and α_2 in equation (1A'). By combining equations (5) and (6), the following estimable equation can be obtained.

$$\Delta \left(\frac{D_{it}}{P_{it}} \right) = \beta_0 \gamma + \beta_1 \gamma \frac{\Delta K_{it}}{P_{it}} - \gamma \frac{D_{i, t-1}}{P_{i, t-1}} + \varepsilon_{it} \quad (7)$$

Since both dividend and investment are normalized by earnings, the specification of equation (7) is no longer biased against possible negative relationship between dividend and investment. If a firm earns more profit in a year, both D_{it}/P_{it} and $\Delta K_{it}/P_{it}$ are not necessarily to increase at the same time although both D_{it} and ΔK_{it} are likely to be greater. If a firm primarily depends on internal funds for investment, then as $\Delta K_{it}/P_{it}$ increases, D_{it}/P_{it} is likely to decrease, and vice

versa. Hence these two variables of this firm are likely to be negatively related. On the other hand, if a firm raises the payout ratio or holds it constant in order to maintain a good capital market relationship for attracting outside funds for investment, D_{it}/P_{it} and $\Delta K_{it}/P_{it}$ of this firm might move in the same direction or show no relationship at all. In addition, since both dividend and investment are expressed as a ratio to profits, inflation can no longer produce spurious correlation between dependent and explanatory variables. By reducing one explanatory variable, the multicollinearity problem in equation (4) is also reduced. Equation (7) is the basic structure to be estimated in this study. According to this specification, $\beta_1\gamma$ is the short-run effect of changes in investment-earnings ratio on the dividend payout ratio and β_1 is the long-run effect.

Before discussion methods of estimating equation (7), the simultaneous-equation problems between investment and dividend decisions should be addressed briefly. As mentioned above, there exist two important studies in the literature which apply simultaneous-equation models to investigate the relationship between dividend and investment decisions of firms. The results obtained are extremely diverse. By applying two-stage least squares (2SLS) and three-stage least squares (3SLS) to cross-sectional data for individual firms, Dhrymes and Kurz [8] have found that investment decisions and dividend decisions of firms are negatively and significantly related. If ordinary least squares (OLS) were applied to each equation, however, the conclusions obtained would have been much different. By applying OLS and 2SLS to time-series data for each of the 298 firms, Fama [9] on the other hand has found that

dividend and investment decisions of firms are either not statistically related or positively related for most of the firms studied. He has also found that 2SLS estimates do not generally perform better than OLS in terms of prediction errors and t-statistics. He suggests that there is no evidence requiring the treatment of dividend and investment decisions as interdependent endogenous variables in a simultaneous-equation model.

As is well known among econometricians, the OLS method is more robust against specification errors than many of the simultaneous-equation methods.³ When specification errors exist in the equations, OLS estimates may be more reliable than those of 2SLS or 3SLS. If a simultaneous-equation model is well specified and hence the predetermined variables chosen can account substantially for the variation of the endogenous variables, according to Maddala [17, p. 241], 2SLS estimates should not be too far from those of OLS. In their studies, Fama [9] and Dhrymes and Kurz [8] have found that 2SLS estimates are much different from those of OLS. Such results probably are indications that specification errors exist in the simultaneous-equation models estimated.

The specification errors most likely lie in the investment function rather than in the dividend equation. For dividends, the partial adjustment model of John Lintner [16] has stood up well in the literature. According to theoretical and empirical studies on investment behaviors of firms, however, desired investment of a firm is primarily affected by profits of investment, which in turn primarily depend on sales and interest rates.⁴ The availability of internal funds might be a factor,

but is not the major factor, affecting investment decisions of firms. By forcing a dividend variable into the investment equation and over-emphasizing the simultaneity between dividend and investment, the model created is likely to contain specification errors. To avoid such problems in this study, simultaneous-equation estimation methods are not adopted.

II. Estimation Methods

As mentioned in the first section, the firms covered in this study are highly heterogeneous. There are different factors which affect the dividend and investment decisions of firms. It is very difficult, if not impossible, to specify a single model capable of reflecting different factors affecting the behaviors of firms. If relevant variables are omitted from a regression equation, as is well known in econometrics, the estimates obtained are likely to be biased. The time-series of each firm is too short to allow the estimation of an equation for each firm with adequate variables and degrees of freedom. Desirable results, therefore, can not be obtained if an equation is estimated for each firm. In this study, cross-sectional and time-series data are pooled in regression to overcome the problem of insufficient degrees of freedom. The error component model is used to taken into account the effect of omitted variable on the estimated coefficients. According to the model suggested by Balestra and Nerlove [2] and Wallace and Hussain [24], the error term in Equation (7) can be written in terms of the sum of three components:

$$\varepsilon_i = w_i + v_t + u_{it} \quad (8)$$

where w_i represents time invariant, unobserved firm effects, v_t represents firm invariant, unobserved time effects on the dividend payout ratio of a firm,⁵ and u_{it} represents the remaining effects which are assumed to vary in both cross-section and time dimensions.

One way to estimate the parameters in equation (7) is to treat w_i and v_t as constants. Under the assumption that u_{it} are independent with zero means and constant variances, least squares regression of $\Delta(D_{it}/P_{it})$ on $\Delta K_{it}/P_{it}$ and $D_{i, t-1}/P_{i, t-1}$ and firm and time dummies can be used to estimate the parameters. This approach is known as the least squares with dummy variable technique (LSDV). As indicated by Maddala [17], the use of the dummy variable technique may eliminate a major portion of the variation among both the dependent and explanatory variables if the between firm and between time-period variation is large. In addition, in some cases, there is also a loss of a substantial number of degrees of freedom. Hence LSDV may not be an efficient method of estimation.

Another approach to deal with equation (7) is to treat w_i and v_t in equation (8) as random.⁶ In this case, instead of N w 's and T v 's, we estimate only the means and the variances of the distributions of w 's and v 's. This is known as the error component model, wherein the regression error is assumed to be composed of three components--one associated with time, another with firms, and the third variable both in the time and cross-sectional dimensions. The assumptions on the components of the error term are that they are independent random variables with constant variances. Without loss of generality, it is also assumed that they have zero means. To estimate the parameters in (7), gener-

alized least squares (GLS) can be used. In matrix notation, equation (7) can be written as:

$$Y = X\beta + \varepsilon \quad (9)$$

where Y is an $NT \times 1$ vector, the elements of which are the observations on $\Delta(D_{it}/P_{it})$ for N firms in T periods, X is an $NT \times 3$ matrix with one's in the first column and the observations on $(\Delta K_{it}/P_{it})$ and $(D_{i, t-1}/P_{i, t-1})$ in the second column. ε is an $NT \times 1$ vector containing the error terms. Under the assumptions on the error components, the variance-covariance matrix of the disturbance terms ε_{it} is the following $NT \times NT$ matrix:

$$E(\varepsilon\varepsilon') = \Omega = \begin{bmatrix} \sigma_w^2 A_T & \sigma_v^2 I_T & \dots & \sigma_v^2 I_T \\ \sigma_v^2 I_T & \sigma_w^2 A_T & \dots & \sigma_v^2 I_T \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \sigma_v^2 I_T & \sigma_v^2 I_T & \dots & \sigma_w^2 A_T \end{bmatrix} \quad (10)$$

where I_T is a $(T \times T)$ identity matrix and A_T is a $(T \times T)$ matrix defined as:

$$A_T = \begin{bmatrix} \frac{\sigma_w^2}{\sigma_w^2} & 1 & \dots & 1 \\ 1 & \frac{\sigma_v^2}{\sigma_v^2} & \dots & 1 \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ 1 & 1 & \dots & \frac{\sigma_u^2}{\sigma_u^2} \end{bmatrix}$$

in which σ_w^2 is the variance of w_1 , σ_v^2 is the variance of v_t , σ_u^2 is the variance of u_{it} , and $\sigma^2 = \sigma_w^2 + \sigma_v^2 + \sigma_u^2$. Given equation (10), it is well known that the generalized least squares estimate of β , if σ_w^2 , σ_v^2 , and σ_u^2 are known, is

$$\hat{\beta} = (X'\Omega^{-1}X)^{-1} (X'\Omega^{-1}Y) \quad (11)$$

with variance-covariance matrix

$$\text{Var}(\hat{\beta}) = (X'\Omega^{-1}X)^{-1} \quad (12)$$

GLS estimates may be more efficient than LSDV or OLS estimates because they enable us to extract some information about the regression parameters from the between group and between time-period variations. In finite samples, Nerlove [20] has also found that it produces little bias.

In actuality σ_w^2 , σ_v^2 and σ_u^2 are usually unknown, but they can be estimated by the analysis of covariance techniques as follows (see, for example, Amemiya [1]):

$$\hat{\sigma}_u^2 = \frac{1}{(N-1)(T-1)} \sum_{i=1}^N \sum_{t=1}^T \left[e_{it} - \frac{1}{T} \sum_{t=1}^T e_{it} - \frac{1}{N} \sum_{i=1}^N e_{it} \right]^2 \quad (13)$$

$$\hat{\sigma}_w^2 = \frac{1}{T} \left[\frac{1}{(N-1)T} \sum_{i=1}^N \left(\sum_{t=1}^T e_{it} \right)^2 - \hat{\sigma}_u^2 \right] \quad (14)$$

$$\hat{\sigma}_v^2 = \frac{1}{N} \left[\frac{1}{N(T-1)} \sum_{t=1}^T \left(\sum_{i=1}^N e_{it} \right)^2 - \hat{\sigma}_u^2 \right] \quad (15)$$

where e_{it} represents residuals obtained by applying the least squares method to the pooled data, assuming that w_i and v_t are constants to be estimated rather than random variables.

If σ_w^2 and σ_v^2 are estimated to equal zero, then Ω in (10) is a $NT \times NT$ identity matrix and hence equations (11) and (12) are the same as the OLS estimators. On the other hand, if the estimate of σ_w^2/σ^2 approaches one and $\hat{\sigma}_v^2$ approaches zero, equations (11) and (12) are equivalent to LSDV with firm dummies; if $\hat{\sigma}_v^2/\sigma^2$ approaches one and $\hat{\sigma}_w^2$ approaches zero, they are equivalent to LSDV with time dummies. Hence in applying GLS rather than OLS or LSDV, the existence of other time or firm effects can be determined by the sample rather than assumed and the relative weights given to between and within firm and time-period variations for the estimation of the parameters are determined by the data. In OLS it is assumed that the between and within variations are just added up; in LSDV the between variation is completely ignored. (See Maddala [17], pp. 341-344).

III. Empirical Results

The data for this study is taken from the 1977 annual industrial file of the Compustat tapes.⁷ The tapes contain data for 20 years (1958-1977). Since data for 1977 are incomplete for most of the firms and data for the first two years are lost due to the need to take the lags of the variables, the sample period of this study is 17 years (1960-1976). The variables in equation (7) are measured as

- D_{it} = Common dividends declared on the common stock of company i in year t .
- P = Net income less preferred dividend requirements, which is the net income available for common,
- K = Net plant and equipment, which represents gross plant minus accumulated reserves for depreciation, depletion, amortization, etc.

The companies listed in the New York Stock Exchange and also in the S & P 400 Industrial Index are the data base of this study. However, those companies, which did not have complete data, did not have positive earnings, or did not pay out dividend in any one year during the sample period, are excluded from the sample. The actual sample includes 256 firms.⁸

Before engaging in regression analysis, all of the firms in the sample were ranked according to the average annual growth rate of total assets in the sample period and divided into three groups: the high-growth group (85 firms), the middle-growth group (86 firms) and the low-growth group (85 firms). The mean values of payout ratio (D_i/P_i) and investment-earning ratio ($\Delta K_i/P_i$) are then calculated for each firm in

the sample period. Growth rates and payout ratios for these groups are listed in Table I. As a preliminary study on the relationship between dividend and investment decisions of firms, the mean of payout ratio was regressed on the mean of investment-earning ratio for the groups of high-growth and low-growth firms. Regression results are presented in Table II. The table shows that the relationships between D_i/P_i and $\Delta K_i/P_i$ are strikingly different between the high-growth and low-growth groups of firms. For low-growth firms, D_i/P_i is negatively and significantly affected by $\Delta K_i/P_i$; and $\Delta K_i/P_i$ alone explains D_i/P_i by almost 50 percent. For high-growth firms, D_i/P_i and $\Delta K_i/P_i$ are positively and significantly related. However, R^2 is only about 6 percent.⁹ Such preliminary results suggest that for low-growth firms dividend decisions and investment decisions are negatively related, but for high-growth firms they are not negatively related.

To further study the relationship between dividend and investment decisions of firms, the error component model discussed in Section II is applied to the data described above for both high-growth and low-growth firms, each regression containing 1445 observations (85 firms and 17 years). Estimated results are given in Table III. Those obtained from OLS and LSDV are also presented in the table for comparison.

Table III reveals that all of the estimated coefficients are statistically significant at the 0.05 level and that the coefficient for $D_{i, t-1}/P_{i, t-1}$ has the correct sign regardless the estimation methods or the groups of firms considered. Estimated results for the same group of firms are not sensitive to the estimation methods used. Generally, the estimates obtained from GLS and LSDV have slightly smaller standard

TABLE I. Growth Rates of Assets and
Payout Ratios by Group of Firms

		High Growth Firms	Middle Growth Firms	Low Growth Firms
Dividend Payout Ratio (mean value in the sample period)	Maximum	0.783	0.962	1.505
	Minimum	0.148	0.237	0.248
	Mean	0.447	0.527	0.595
	(standard error)	(0.115)	(0.115)	(0.155)
Growth rate of real Assets (mean percen- tage annual growth)	Maximum	37.15	12.12	8.30
	Minimum	12.20	8.32	3.37
	Mean	16.33	9.96	6.57
	(Standard error)	(4.54)	(1.10)	(3.37)

TABLE II.

Empirical Relationships between the Average
Payout Ratio and the Average Investment-Earning
Ratio of Three Groups of Firms
(Dependent Variable = D_i/P_i)

	Constant	$\Delta K_i/P_i$	R^2	D.W.	N
Low Growth Firms	0.597* (49.19)	-0.221* (-8.89)	0.488	1.79	85
High Growth Firms	0.434* (32.31)	0.023* (2.29)	0.059	1.74	85

NOTE: D_i/P_i is the mean of payout ratio and $\Delta K_i/P_i$ is the mean of investment-earnings ratio for i th firm in the sample period. Figures in parentheses are t ratios. The N is the number of firms in the group.

* Indicates that a coefficient is statistically significant at the 0.05 level.

TABLE III.

Estimated Results Obtained from
the Pooled Data

(The dependent variable = $\Delta \frac{D_{it}}{P_{it}}$)

Estimation Method	Constant	$\Delta K_{it}/P_{it}$	$D_{i, t-1}/P_{i, t-1}$	\bar{R}^2
Low Growth Firms				
OLS	0.570 (27.92)	-0.111 (-12.36)	-0.884 (-35.31)	0.480
LSDV	0.689 (5.31)	-0.108 (-11.84)	-0.965 (-36.92)	0.499
GLS	0.583 (19.86)	-0.111 (-12.42)	-0.904 (36.04)	0.501
High Growth Firms				
OLS	0.314 (35.72)	0.051 (51.79)	-0.796 (-51.24)	0.792
LSDV	0.407 (9.50)	0.053 (62.93)	-0.906 (-65.28)	0.860
GLS	0.356 (17.70)	0.053 (63.01)	-0.891 (-64.95)	0.860

NOTE: Both time and firm dummies were included when LSDV was used. The coefficients for the dummy variables are not presented here to save the space; they are available from the author. The figures in parentheses are t-ratios. There are 85 firms and 17 years observations each for both high-growth and low-growth firms.

errors than those obtained from OLS. A comparison of the coefficients of the investment variable for the two groups of firms again discloses the striking difference in behaviors between low-growth and high-growth firms regarding dividend and investment decisions. The estimated coefficient of $\Delta K_{it}/P_{it}$ for the low-growth firms is negative and significant while that for high-growth firms is positive and significant. Such empirical results conform with the hypothesis that for low-growth firms dividend and investment decisions are negatively related, but they are not negatively related for high-growth firms. One of the two theories explained in the first section, that dividend and investment decisions of high-growth firms should be negatively related, is thus rejected. The results suggest that high-growth firms are not likely to reduce the payout ratio in order to increase investment since such action might detract from their ability to attract external funds. For low-growth firms, dividend and investment decisions are negatively related since they are competing uses of funds. The above results partially contradict with the finding of Fama [9], that dividend and investment decisions of firms are not related. The finding of Dhrymes and Kurz that the two decisions are negatively related, is not fully supported here either.

IV. Summary and Conclusion

In the preceding sections, theories on the effect of growth orientation on dividend-investment decisions of firms has been introduced. A new theoretical model for the study of relationship between dividend and investment decisions of firms has been presented. The model is based on

the partial adjustment model and the signalling-theory approach. The variables, however, have been normalized by the earnings so that spurious correlation and multicollinearity problems can be avoided or reduced. It has also been pointed out that over-emphasizing the interdependence of investment and dividend decisions of a firm and hence adopting a simultaneous-equation estimation method might create specification errors and generate biased estimates. Statistical methods for the estimation of equations from pooled cross-sectional and time-series data have been introduced. Empirical results have shown that for low-growth firms the mean values of payout ratios over the sample period are negatively and significantly related to the mean values of investment-earning ratios. For high-growth firms, they are positively and significantly related. Results obtained from the pooled data also revealed a positive and significant relationship between dividend decisions and investment decisions of high-growth firms, and a negative and significant relationship between the two decisions of low-growth firms. The results suggest therefore that for high-growth firms the desire to pay reasonable dividends and hence signalling earning potentials causes dividend decisions of such firms not to be adversely affected by investment decisions, while for low growth firms investment decisions do adversely affect dividend decisions.

Theoretically, this paper has integrated the "information content" argument with "flotation cost argument" to derive an indicator for explaining the generalized interaction relationship between the dividend decisions and investment decisions. The applications of this new model for forecasting dividends and explaining Shiller's [22] findings about

the relationship between the stock price and the change of dividends will be explored in the future research. It might also be useful to integrate the new model derived in this paper to generalize the empirical results obtained by Lee and Djarrraya [15]. .

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FOOTNOTES

1. See Fama [9], Brittain [6], Fama and Babiak [10], Mayer and Kuh [18], Dhrymes and Kurz[8], and others.
2. These variables are the same as those used in Fama [9]. They will be defined more precisely in Section III.
3. For a discussion of the robustness of the OLS method, see Maddala [17, p. 231].
4. For a study on investment behavior, see Jorgenson [11].
5. The firm effect refers to the effect of factors affecting the behavior of an individual firm; it is constant over time. The time effect refers to the economic condition of particular time point; it varies over time.
6. For studies of this sort see, for example, Balestra and Nerlove [2], Wallace and Hussain [24], Maddala [17], and Chang and Lee [7].
7. The Compustat tapes are documented in the Compustat Manual, supplied by Standard & Poor's Compustate Services, Inc., 7400 S. Alton Court, Englewood, Colorado 80112.
8. A list of these firms is available from the author.
9. To investigate the effect of high payout and low payout in capital asset pricing, Bar-Yosef and Kolodny [3] and Lee and Chang [14] have used the same method to reduce (or eliminate) the classification errors. We use a similar method to perform our empirical studies.

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